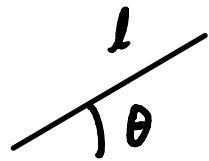


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29. (II) A stick of length ℓ_0 , at rest in reference frame S, makes an angle θ with the x axis. In reference frame S', which moves to the right with velocity $\vec{v} = v\hat{i}$ with respect to S, determine (a) the length ℓ of the stick, and (b) the angle θ' it makes with the x' axis.

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$$\vec{v} = v\hat{x}$$

$$l_y' = l_y = l_0 \sin \theta$$

$$l_x = l_0 \cos \theta \rightarrow l_x' = l_x \sqrt{1 - v^2/c^2} = l_0 \cos \theta \sqrt{1 - v^2/c^2}$$

Eq. 36-3a

a)

$$l = \sqrt{l_x'^2 + l_y'^2} = \sqrt{l_0^2 \cos^2 \theta (1 - v^2/c^2) + l_0^2 \sin^2 \theta} = l_0 \sqrt{1 - (v \cos \theta)^2/c^2}$$

b)

$$\tan \theta = \frac{l_y}{l_x} \rightarrow \theta' = \arctan\left(\frac{l_y'}{l_x'}\right) = \arctan\left(\frac{l_0 \sin \theta}{l_0 \cos \theta \sqrt{1 - v^2/c^2}}\right) = \arctan\left(\frac{\tan \theta}{\sqrt{1 - v^2/c^2}}\right) = \arctan(\gamma \tan \theta)$$